# III. SURFACE WATER ASSESSMENT

## F. ESTUARY AND COASTAL ASSESSMENT

### 1. Designated Use Support

All of the 156.29 square miles of estuarine waters were reviewed for this report. Over 99% (156.23 square miles) of the estuarine waters have enough data to be considered assessed for this report. Of those areas 99% (154.42 square miles) are considered monitored and approximately 1% (1.82 square miles) are considered evaluated. It is important to note that the large percent of estuarine waters considered assessed (99%, 154.42 square miles) are, in general, only monitored for pathogens by the RIDEM Shellfish Monitoring Program. Therefore, the majority of Rhode Island's estuarine waters have current monitoring data for pathogens to assess for swimming and shellfishing use support status but limited or old (evaluated) monitoring data to assess for aquatic life use support. Limited bay-wide sampling conducted during the summers of 2000 and 2001 collected dissolved oxygen data which has increased the information available for assessing the aquatic life use support.

Table 3F-1 presents a summary of the degree of use support and the estuarine areas that are monitored and evaluated. Just over 69% (108.6 square miles) of the estuarine waters fully support *all* assessed. Approximately 30% (47.64 square miles) of the estuarine waters assessed are considered impaired for one or more uses.

Data was available to assess 155.75 square miles of estuarine waters for swimming use. As Table 3F-2 shows, most estuarine waters assessed support their swimming uses (94%, 145.83 square miles). Approximately 6% (9.92 square miles) of the estuarine waters assessed are considered impaired for the swimming use due to violations of fecal coliform criteria.

Data was available to assess 116.41 square miles of estuarine waters for aquatic life use. For aquatic life use, the majority of estuarine waters assessed fully support aquatic life needs (64%, 74.52 square miles). Approximately 36% (42 square miles) of the estuarine waters assessed are impaired for aquatic life uses.

The estuarine waters classified as SA and SA{b} are designated for shellfishing uses. Excluding Rhode Island Sound and Block Island Sound, this represents approximately 132.66 square miles. Data was available to asses 131.35 square miles of SA and SA{b} for their shellfishing use support status. The majority of Class SA and SA{b} waters (79%, 104.19 square miles) fully support the shellfishing use. Partial support of the shellfishing use occurs in approximately 16% (21.39 square miles) of the estuarine waters. In general, this 21.39 square miles encompasses areas with a seasonal or conditional shellfish closure associated with it. Approximately 4.5% (5.77 square miles) of the Class SA and SA{b} estuarine waters are permanently closed to shellfishing and are considered not supporting the shellfishing use.

Rhode Island has 78.62 coastal shoreline miles. Data was available to assess the coastal shoreline for swimming and shellfishing use support status. All 78.62 miles were assessed as fully supporting both swimming and shellfishing uses.

Table 3F-1. Summary of Fully Supporting, Threatened and Impaired Waters in Estuarine Waters (square miles)

| Degree of Use Support | Assessment Category | | Total Assessed |
|---|---|---|---|
| | Evaluated | Monitored | |
| Size Fully Supporting All Uses Assessed | 0.67 | 107.92 | 108.59 |
| Size Fully Supporting all Assessed Uses but Threatened for at Least One Use | 0 | 0 | 0 |
| Size Impaired for One or More Uses | 1.15 | 46.49 | 47.64 |
| Size Not Attainable for Any Use and Not Included in the Line Items Above | 0 | 0 | 0 |
| TOTAL ASSESSED | 1.82 | 154.41 | 156.23 |

Table 3F-2 Individual Use Support Summary for Estuarine Waters (square miles)

| Individual Use | Size Assessed | Size Fully Supporting | Size Fully Supporting but Threatened | Size Partially Supporting | Size Not Supporting |
|---|---|---|---|---|---|
| Aquatic Life | 116.41 | 74.52 | 0 | 5.28 | 36.61 |
| Shellfishing | 131.35 | 104.19 | 0 | 21.39 | 5.77 |
| Fish Consumption | 0 | 0 | 0 | 0 | 0 |
| Swimming | 155.75 | 145.83 | 0 | 4.26 | 5.66 |

## 2. Causes and Sources of Impairment of Designated Uses

Causes and sources of impairment for assessed waters that do not fully support their designated uses are listed in Tables 3F-3 and 3F-4, respectively, according to EPA guidance. Causes are those pollutants or other stressors that contribute to the actual or threatened impairment of designated uses in a waterbody. Sources are the facilities or activities that contribute pollutants or stressors, resulting in impairment of designated uses in a waterbody. In general, the actual sources of impairment are not determined until a TMDL (total maximum daily load) is conducted on the waterbody. As such, most of the sources listed are just potential sources. If the waterbody specific information indicated impact on designated use as being high, it is indicated under the "major impact" column of Table 3F-3 and 3F-4. If the impact was determined to be moderate, it is listed on the tables in the "moderate" impact column.

The major impacts on designated uses for the estuarine waters of Rhode Island are due to bacterial contamination, low dissolved oxygen, and nutrient enrichment. The major sources of bacterial contamination are due to combined sewer overflows (CSOs). CSOs, urban runoff and point source discharges are sources of the nutrient enrichment and low dissolved oxygen problem in the Upper Bay and coves. This water quality problem, while not fully characterized, indicates that nutrients are linked to adverse impacts of reduced dissolved oxygen levels.

Table 3F-3. Square Miles of Estuarine Waters Impaired by Various Cause/Stressor Categories

| Cause/Stressor Category | Size of Waters by Contribution to Impairment | |
|---|---|---|
| | Major | Moderate |
| BIODIVERSITY IMPACTS | 10.72 | |
| EXCESS ALGAL GROWTH/CHL-A | 5.74 | 0.32 |
| METALS | 3.61 | 4.73 |
| NUTRIENTS | 6.23 | 18.34 |
| LOW DO | 16.79 | 24.18 |
| PATHOGENS | 9.12 | 27.09 |
| THERMAL MODIFICATIONS | 9.82 | |
| TOTAL TOXICS | 0.99 | |
| UNKNOWN TOXICITY | 0.03 | |

Table 3F-4. Square Miles of Estuarine Waters Potentially Impaired by Various Source Categories

| Source Category | Potential Contribution to Impairment | |
|---|---|---|
| | Major | Moderate |
| AGRICULTURE | | 2.55 |
| COMBINED SEWER OVERFLOW | 24.28 | |
| CONTAMINATED SEDIMENTS | 0.90 | |
| GROUNDWATER LOADINGS | | 3.52 |
| INDUSTRIAL POINT SOURCES | 9.82 | |
| INTENSIVE ANIMAL FEEDING OPERATIONS | | 0.73 |
| LAND DISPOSAL | 1.22 | 5.62 |
| MARINAS AND RECREATIONAL BOATING | 1.79 | 5.31 |
| MUNICIPAL POINT SOURCES | 14.45 | 5.20 |
| NATURAL SOURCES | 0.69 | 3.15 |
| SOURCE UNKNOWN | 1.89 | 1.34 |
| URBAN RUNOFF/STORM SEWERS | 31.44 | 13.93 |

3. Narragansett Bay

a. Background: A History of Bay Pollution

During the characterization phase in the development of the Narragansett Bay CCMP, a variety of monitoring and baseline assessment programs were conducted throughout the Narragansett Bay watershed (1985-1991). Measurements were taken of water quality, trace metals in hardshell clams, and toxic contaminant levels in sediments. Sampling programs completed by the NBEP were limited in coverage to the main channels due to the high costs of estuarine environmental monitoring. This same fiscal constraint has limited historical state field monitoring within the Bay's waters mainly to bacterial surveys to certify shellfish waters and specialized research efforts performed by federal and university research scientists for purposes other than management decision-making. Therefore, few baywide long-term data sets exist for assessing water quality trends in the Bay and its harbors.

However, as shown by Dr. Scott Nixon of the University of Rhode Island in a review of the historic changes in nutrient loads to the Bay, changes in pollutant loads can be surmised from other sources. Investigation of old navigation maps and historic fisheries documents often provide descriptions of historic locations of eelgrass beds and significant changes in bay natural resources noted by those involved in commerce. Estimates and actual dates of initial changes in the transport of pollutants to the bay can be developed from a detailed knowledge of the socio-economic history of the watershed. For example, Dr. Nixon contends that the initial step in the significant increase of total direct loads of bacterial and nutrient pollutants to the Providence River/Upper Narragansett Bay began on Thanksgiving Day, 1871! On that day, a centralized city-wide water delivery system was turned on in Providence, and brought an almost immediate increase in water consumption due to cheap, easy access to a (then) clean source of drinking water: the Pawtuxet River. Following this technological breakthrough, the newly developed flush toilet became rapidly popular as a means to remove human wastes from human sight and mind. The disposal systems such as in-ground cesspools used at the time experienced rapid failures, and the drainage ditches and urban area rivers began to experience serious introduction of human wastes.

By 1892, a sewer collection system was developed to channel the evil-smelling overflows to Fields Point and discharge the wastes untreated into the Providence River. By the early 1900's, basic treatment was provided through chemical precipitation, dewatering, and barging of the sludge out to Prudence Island at mid-Bay. This process continued until the initiation of more "modern" engineering designs for primary wastewater treatment plants. Such historic information provides a basis for a "Sherlock Holmes" approach to the history of pollution in the bay.

A second source utilized by the NBEP is the information which can be extracted from sediment cores by measuring concentration of conservative pollutants such as some heavy metals along with radioisotope marker techniques to provide benchmark dates associated with specific core depths. URI researcher Dr. John King's work for the NBEP has provided a valuable historic record of metal trends in the sediments throughout the bay.

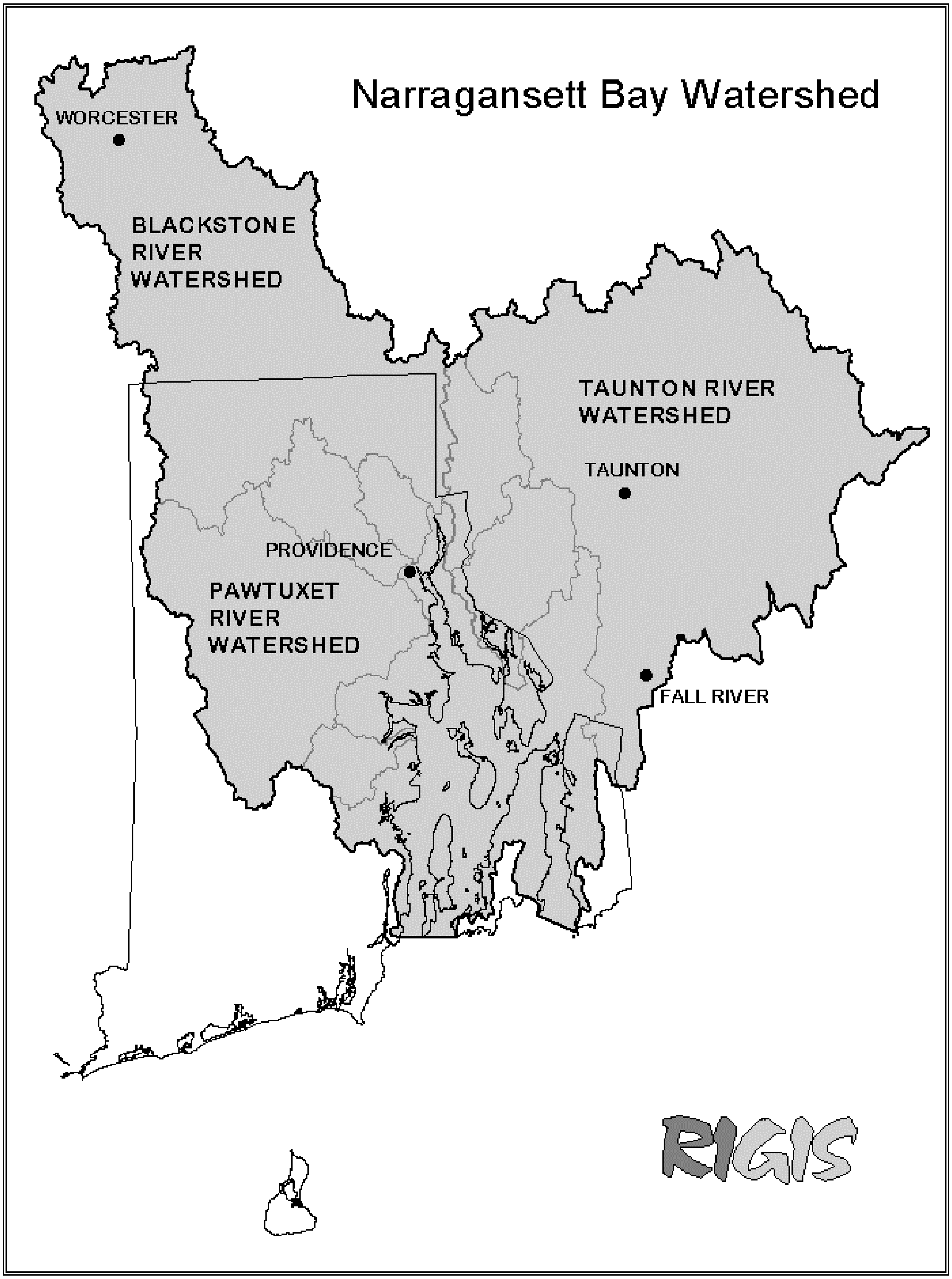
b. Description Of Priority Problems

The Bay's economic importance to Rhode Island is clear: the Bay generates billions in revenues for the State of Rhode Island based on direct exploitation of Bay fisheries, tourism, marine-related industry, marine research and education, and U.S. Navy-related activities. Tourism alone in Rhode Island has been increasing steadily, and much of the state's tourism attraction is linked to the Bay. The R.I. Economic Development Corporation has estimated that tourism revenues hit an all-time new high of $3.26 billion in 2000.

The Bay watershed - the land area that ultimately drains water (and entrained pollutants) to Narragansett Bay - is over ten times larger than the surface area of the Bay itself, and extends well into the Commonwealth of Massachusetts (see Figure 3F-1). In fact, 60 percent of the Bay basin lies within the Commonwealth up to the headwaters of the Blackstone and Taunton Rivers, and 67 of the 100 cities and towns in the Bay basin are in Massachusetts.

Narragansett Bay's water and habitat quality reflects its urban history and recent suburban pattern of development, as well as the multiple demands placed on it by its citizens. Population density within the Bay basin affects both the volumes of water use and ultimate wastewater discharge. The Narragansett Bay watershed is one of the most densely populated estuarine systems in the country with an overall density of over 1,109 people per square mile compared to a national average of 64 people per square mile. Most of the wastewater flow generated in the basin is treated by one of the 33 wastewater treatment facilities in the basin, although 12 Rhode Island communities are completely unsewered as are several in Massachusetts. Since the population and industrial centers continue to be concentrated in the metropolitan areas of Providence, Rhode Island, and Worcester and Fall River, Massachusetts, the largest volumes of wastewater enter Narragansett Bay at the mouths of the Blackstone, Pawtuxet, Providence-Seekonk, and Taunton Rivers. The largest volumes of industrial wastewater and industrial-derived toxic pollutants and nutrients also enter Narragansett Bay at these points.

FIGURE 3F-1 Narragansett Bay Watershed map



The monitoring completed during the characterization phase of The NBEP corroborates this picture of greatest pollution levels at the head of the Bay. Data developed from this work has improved our understanding of the relative importance of the rivers and municipal wastewater treatment facilities (WWTFs) towards the total loadings of toxic pollutants as well as nutrients and bacterial indicators to Narragansett Bay. Results show a clear pollution gradient which follows the North-South axis of the Providence River/Upper Bay. The major sources include upstream WWTFs on the Blackstone and Pawtuxet Rivers, contaminated riverine sediments, combined sewer overflows (CSOs) in wet weather, and the two major WWTFs which discharge to the Seekonk/Providence Rivers. Based on wet and dry weather loadings estimates, the major river loadings (which include upstream WWTF and nonpoint inputs) potentially provide over 50% of the suspended solids, nitrates, cadmium, chromium, lead, PCBs, and PAHs, to the Providence River/Upper Bay for wet + dry periods, while the two major WWTFs discharging directly to this area contribute over 50% of the load for ammonia, orthophosphate, petroleum hydrocarbons, copper, and nickel. The major problem of shellfishing closures to the upper Bay due to violation of the fecal coliform standard is clearly linked to wet weather events which contribute approximately 80% of the load released through WWTF bypasses and untreated sewage discharged at combined sewer overflows (CSOs).

Toxic pollutant loadings to the Bay are decreasing due to tight environmental regulations covering industrial and municipal discharges. The pretreatment program at the Narragansett Bay Commission WWTF have documented a 90% decrease over the last decade in toxic metal concentrations in the wastewater going into the Bay. However, projected changes in population growth and population density suggest that a different type and pattern of pollution problems may emerge in the future.

The Rhode Island Statewide Planning Program (SWP) has projected an average 20 percent growth rate for Rhode Island's suburban and rural communities between 1985 and 2010, compared to a 2.6 percent growth rate in the state's cities, and a statewide growth rate of 9.5 percent. Although 69 percent of the state's population already lives in a coastal city or town, coastal communities are expected to grow more rapidly than the state averages. In addition, based on the projected rate and distribution of growth, the SWP estimates that 88 percent of the developable lands in Rhode Island could be fully developed by 2010. Coastal towns in the Narragansett Bay basin have experienced dramatic population growth and development since the 1970s. Since demographic projections indicate that future growth will continue to concentrate in rural and suburban areas, many of which are unsewered, the population's dependency upon ISDSs will also increase.

c. High-Nutrient Impacts (Eutrophication)

A number of coves and embayments around Narragansett Bay, including the Pawtuxet, Providence, Seekonk, Kickemuit, Palmer River, Greenwich, Apponaug and Warwick Coves; and portions of Mount Hope Bay, presently suffer from seasonal dissolved oxygen depletion, algal blooms and occasional fish kills related to excess nutrients coming from many sources, including WWTF discharges and failing septic systems. If this trend toward suburbanization and development of rural areas continues or accelerates without adequate consideration of impacts related to increased density of on-site septic system and stormwater discharges from expanding impervious surface (roads, parking lots, etc.), there are likely to be significant probable consequences for poorly flushed marine areas in down-Bay communities. The problems already experienced by some coastal communities have included changes in the marine communities to less desirable pollutant tolerant species due to excess nutrients, which cause excessive growth of algae and/or benthic "nuisance" seaweeds like sea lettuce (*Ulva*) and late-summer low dissolved oxygen fish kills in poorly flushed coves; habitat loss/ degradation of coastal wetlands and high quality bottom habitat such as eelgrass beds; and further closures of former shellfishing areas due to increased fecal coliform levels associated with stormwater runoff. These problems are all associated with poorly planned rapid coastal development over the last 20 years, and the associated wet weather pollution coming from untreated road/parking lot drainage and failing septic systems, as well as the probable contribution of groundwater nitrates from adequately-working septic systems entering poorly flushed coves and subembayments.

d. Sewage

Human sewage represents one of the most ubiquitous pollution problems in the Narragansett Bay basin. Based on 1990 census figures for Rhode Island and Massachusetts and per capita estimates of water use, over 125 million gallons of wastewater carrying a mixture of sanitary and household wastes are discharged each day to municipal wastewater treatment facilities (WWTF) and on-site individual sewage disposal systems (ISDS) in the basin. Sewered areas receive some level of treatment and disinfection prior to discharge to the Bay and its tributaries. However, 37 percent of Rhode Island's population depends upon ISDSs to treat residential and commercial wastes. In addition, over 100 combined sewer overflows (CSO) in the Providence River region and the City of Fall River discharge a mixture of untreated sewage and stormwater to the Bay after rain events. In these urban areas, stormwater impacts, especially WWTF bypasses and CSOs, represent the major sources of human fecal waste. The CSOs are also a major source of floatable human wastes, which foul the coastline and aesthetically limit use of the shore. In suburban and developing coastal areas, the major sources of human fecal wastes include failing ISDSs, illegal sewer cross-connections to storm drains, and improper sewage discharges from vessels.

At the present time, approximately 20 percent of Narragansett Bay is permanently or conditionally closed to shellfish harvesting because of actual or suspected contamination from sewage-derived bacteria and viruses. The Providence River and a portion of Mount Hope Bay have been permanently closed to shellfish harvesting since the 1940s. The upper Narragansett Bay, a portion of Mt. Hope Bay, the Kickemuit River, and Greenwich Bay are routinely closed following rain storms because of CSO discharges of untreated sewage or increasing levels of fecal coliform bacterial contamination from various nonpoint sources.

e. Toxic Pollutants

The Providence-Worcester corridor along the Blackstone River is acknowledged as the birthplace of the Industrial Revolution in the United States, and upper Narragansett Bay continues to reflect this heritage. Significant areas of the Providence River and its major tributaries, including the Blackstone, Pawtuxet, Woonasquatucket, Moshassuck and Ten Mile Rivers, continue to exceed federal and state water quality standards designed to protect aquatic life from exposure to toxic pollutants. Other less urban areas of the Bay, including parts of Portsmouth and Newport Harbor, Greenwich Bay and Mount Hope Bay, also show evidence of significant metals contamination although not in violation of federal and state standards.

Industry has historically been the largest source of toxic pollutant discharges to Narragansett Bay. However, federal, state, local and industry initiatives undertaken due to the federal Clean Water Act have resulted in significant reductions in industrial pollutant loadings since the 1970s. As a result, sources such as commercial and household toxic and hazardous wastes, motor vehicle and other air emissions, and urban and highway runoff are increasingly significant sources of contamination throughout the Bay basin. In addition, suburbanization and diffusion of commercial growth away from existing industrial centers, combined with the emergence of new industries with "exotic" waste characteristics, have resulted in new sources and types of surface and groundwater contamination in developing areas of the Bay basin.

The levels of measured toxic pollutants in Bay waters do not pose an immediate public health risk, in part because the most severely contaminated areas are already closed to shellfish harvesting due to sewage contamination. However, the presence and persistence of certain toxic pollutants in the environment are likely to contribute to habitat degradation, especially within the vicinity of highly contaminated sediment "hot spots". In addition, the presence of such contaminated sediments in the Providence River basin and other commercially important ports and harbors complicates decision-making about disposal of sediments removed during maintenance dredging necessary to support navigation, shipping, and boating activity. A concerted effort needs to be maintained to reduce use and disposal of toxic pollutants through continuing source reduction and pretreatment efforts by industry. The importance of stormwater sources of toxic contaminants also needs to be seriously dealt with through stormwater treatment designs to remove sediments carrying the pollutants to the rivers and the Bay.

f. Living Resources

There is a need to adequately coordinate both statewide and local efforts to effectively protect water supply recharge areas, upland riparian corridors, intertidal and subtidal habitats, and key breeding, nursery and foraging habitats. This also applies to efforts designed to effectively preserve unique, ecologically important, or remnant natural resources or populations.

Both Rhode Island and Massachusetts have experienced declines and collapses of important fisheries such as the Winter Flounder in recent years. Other historically important fisheries such as the oyster, bay scallop, soft shell clam, Atlantic salmon, shad, menhaden, tautog, and windowpane flounder have experienced similar declines due to complex factors and changes in their environment, including subtle shifts in average and maximum/minimum Summer and Winter water temperatures, changes in natural populations of predators and/or prey of the young of these species, overfishing, physical obstruction of river flow and drainage, destruction and loss of key subtidal habitats such as eelgrass beds, and pollution. In addition, apart from the states' efforts to identify land-based state and federally-listed threatened and endangered species and their habitats, little governmental attention has been paid to documenting marine threatened/ endangered species or protecting non-commercially important marine species and their associated habitats. Additionally, introduced non-indigenous species such as the Asian shore crab (Hemigrapsus sanguiness) are showing up in the Bay with unknown ecological consequences.

A concerted regional effort will be necessary to effectively manage and sustain commercial and recreational harvests of fisheries. In addition, land use controls and land acquisition efforts within Rhode Island and Massachusetts should be coordinated to focus on critical areas threatened by suburbanization and rural development in order to protect or restore remnant critical habitats for native plants and animals, as well as to protect human use and enjoyment of these resources. Unless there is a political will both at the state *and* local level to fully identify and protect critical habitat areas in and around the Bay's shore, we face the expected results of loss of biological diversity, sustainable ecosystem function, and human use and enjoyment of these resources. There is also a rapidly increasing need to more carefully oversee the use of the Bay's natural resources as these populations continue their decline. Additional fisheries surveys, conducted on a continuing basis, to develop estimates of the actual population size of various important Bay species (e.g., Quahogs), and scientifically-based, practical management policies and plans are needed to ensure that such commercially and recreationally important species are sustained at levels adequate to continue to provide jobs to the commercial and tourist sectors.

Table 3F-5 lists the extent of coastal and Bay habitat in acres based on analysis done of 1996 color aerial photos of Narragansett Bay and nearshore areas. Note that there are less than 100 acres of eelgrass, a critical habitat for fish and shellfish, left in the Bay. Historical evidence suggests that there were once hundreds of acres of this vital habitat across the Bay.

Table 3F-5

**Acreage Summary of**
**Estuarine and Marine Habitats Inventoried**
**in Narragansett Bay Project Area - 1996**

| **Habitat Type** | **Area in Acres** |
|---|---|
| Open Water | 124,259.4 |
| High Salt Marsh | 2,708.7 |
| Beaches | 1,450.5 |
| Rocky Shores | 573.3 |
| Tidal Flats | 568.6 |
| Low Salt Marsh | 443.2 |
| Brackish Marsh | 427.6 |
| High Scrub-Shrub Marsh | 159.3 |
| Eelgrass Beds | 99.5 |
| Pannes & Pools | 46.3 |
| Dunes | 43.0 |
| Artificial Jetties & Breakwaters | 23.1 |
| Oyster Reefs | 9.0 |
| Stream Beds | 3.5 |
| TOTAL | 130,815.0 |

Source: *Report on the Analysis of True Color Aerial Photographs to Map Submerged Aquatic Vegetation and Coastal Resource Areas in Narragansett Bay Tidal Waters and Nearshore Areas, Rhode Island and Massachusetts.* Prepared by Irene Huber, Natural Resources Assessment Group, University of Massachusetts, November 1999. Narragansett Bay Estuary Program Report No. 117.

g. Progress To Date And The Unfinished Agenda

A summary of significant Bay problems, ranked by region, are found in Table 3F-6. A great deal of progress has been made in spite of the complexity of the issues facing us. Data compiled by The NBEP suggest that programs initiated under the federal Clean Water Act, such as mandatory secondary sewage treatment, the industrial pretreatment program, and the phase-out of leaded gasoline, have measurably improved dissolved oxygen concentrations and reduced toxic pollutant loadings to Narragansett Bay. The most significant evidence of the environmental benefit of this investment can be seen in the Providence River. Here, there has been some success achieved over the last decade in terms of decreasing levels of toxics, especially heavy metals, due most likely to better (secondary) treatment and removal of suspended solids at the WWTFs (metals tend to attach to such particles), as well as progress within industrial pretreatment programs.

This decrease has been corroborated by two separate sources. Sediment cores taken for the NBEP clearly record an exponential decrease in pollutants as one travels down the Providence River and out into the upper and mid Bay. Some of the cores from the lower Providence River as well as the upper Bay provide a story showing a slow increase in metal concentrations since the late 1800's, with the sharpest increases between the 1950's and the late 1970's. This is followed by a slight decrease in concentration and accumulation rates for many of the heavy metals since the early 1980's. Meanwhile, as noted previously WWTF pretreatment programs have shown a decrease of over 90% in total metal loadings in their effluent since 1981. Continued progress within the pretreatment programs, as well as continued vigilance with level of treatment at the WWTFs should ensure that this trend is not reversed.

State initiatives such as mandatory recycling and toxics' source reduction programs are expected to further reduce pollutant inputs. Rhode Island's open space acquisition program and management efforts by RIDEM to protect the winter flounder population also represent important initiatives with respect to protection of critical resources, and establishing modern principles of resource management. The recent emphasis on development of aquaculture in the Bay is another positive tool in maximizing the amount of sustainable marine resources. However, these efforts will need to be carefully planned in order to limit impact to the Bay water quality and sediments from the more intensive aquaculture methods such as fishpen culture due to fish wastes and uneaten food rotting on sediments below the pens.

Plans are also closing in on the hundred year old issue of the CSOs. The Narragansett Bay Commission (which oversees the Field's Point and Bucklin Point WWTFs) has initiated plans to hold back and treat the stormwater/ sewage flow from the CSOs in Rhode Island. This excess flow will be treated at the WWTFs after the storm has passed.

Discharge of boater sewage is also being addressed. A Narragansett Bay Marina Pumpout Siting Plan was developed by NBEP staff. With an estimated 160 private marinas, yacht clubs, boat yards, town docks, and launching ramps operating in the Bay, and over 32,000 registered boats (1991) being served by approximately 14 pumpouts in 1993, the installation of additional pumpout facilities was recognized as a need to maintain water quality standards, improve water quality and protect open shellfishing grounds. The result of these actions was the designation of all marine waters of Rhode Island as a "no-discharge" area by EPA in 1998. Due to the combined efforts of the NBEP and the RIDEM Office of Water Resources, funding obtained through the Clean Vessel Act grant program and the Wallop-Breaux Boating Access Fund has brought the total number of pumpout facilities above the threshold required (40+) which allowed all marine waters in Rhode Island to meet the “no-discharge” goal.

The situation with nutrients is less positive, although historical evidence has shown that decreases in suspended solids and biochemical oxygen demand (BOD) required by the Federal Clean Water Act have clearly had some positive effect. Comparison of recent spot data with historical descriptions and some incomplete data from early and mid 1900s suggests that present dissolved oxygen levels in the Seekonk and Providence Rivers are the higher than in the early 1900's. Old reports indicate that there were frequent anoxic events (*no* dissolved oxygen) and fish kills in these areas in the late 1940's and mid 1950's. However, modern secondary sewage treatment is *not* designed to remove nutrients, especially the nitrogen-containing nutrients that can cause excess plant productivity in marine waters. There are still significant seasonal extreme hypoxic (low oxygen) events in the Seekonk/Providence Rivers today throughout the warm summer months. The high level of plant (phytoplankton) productivity in the Providence River due to the high nutrient levels from both the Blackstone River and the major WWTFs is a significant part of this problem. When these organisms die and decay, hypoxia or anoxia can result under the right conditions.

This potentially costly issue of nutrient control will need to be addressed in the future. It will not be easy due to the many nutrient sources. A study of the phytoplankton productivity in the Providence River has examined how severe the dissolved oxygen situation is, and how it is linked to the plant productivity in the water. Such studies should help focus management efforts to control pollutant inputs to this urban area in a cost effective manner. RIDEM is also starting to incorporate limits on nutrients into its permits for wastewater treatment plants and several plants have embarked on voluntary planning efforts geared toward cost-effective nutrient reduction techniques.

For local communities, a virtual revolution in land management philosophy and practice, such as the serious consideration of requiring at least minimal adequate maintenance/upkeep of septic systems through wastewater management districts (a state law allows any community to develop such districts). This is now being addressed as some communities (Charlestown, New Shoreham) are adopting these septic system management districts. The RIDEM Nonpoint Source Pollution Program has worked with the R.I. Clean Water Finance Agency to provide low-interest loans to municipalities to implement these management district programs. Other needs may include denitrification (removing nitrates) designs for minimum acceptable ISDS treatment within the vicinity of nutrient-sensitive coves and salt ponds. Such local responses are sorely needed to deal with the incremental, cumulative degradation of water quality related to increased ISDS density. Requirements to reduce direct stormwater runoff will also be critical. The environmental consequences of failing to effectively manage development impacts are readily observable in terms of increasing restrictions on shellfish harvesting, and the increased incidence and geographic extent of seasonal low oxygen problems, algal blooms and fish kills in the vicinity of intensively developing residential areas and crowded harbors.

The trend toward suburbanization and dispersion of the population to currently undeveloped areas of the Bay basin will also result in the physical loss of remaining unprotected natural habitats. In addition, the unregulated development of open space within the watershed— including deforestation and encroachment on wetlands—can also disrupt the natural water cycle, increase stormwater runoff, promote erosion, and result in new point and nonpoint sources of pollution. Evidence of these effects already exists. For example, the SWP reported a 15 percent decrease in the acreage of forested lands between 1982 and 1988 associated with the development boom of that period, and the U.S. Department of Agriculture Natural Resource Conservation Service (USDA NRCS) estimates that over 100,000 tons of sediment are washed into the Bay and its tributaries each year as the result of unregulated runoff from construction sites, road surfaces, and agricultural lands. The consequences of failing to effectively manage land use include the physical loss and/or degradation of natural resources, loss of biological diversity, increasing limitations on water quality-dependent uses, and ultimately, a decrease in the Bay's fisheries.

Table 3F-6 **SUMMARY OF BAY PROBLEMS, RANKED BY REGION**

| **BAY-WIDE** | | | |
|---|---|---|---|
| **PROBLEM(S)** | **CAUSE(S)** | **SOURCE(S)** | **RISKS** |
| 1. Loss of major fisheries | 1. Overfishing | 1. Efficiency of harvesting techniques and level of effort.<br>2. Lack of adequate information and resource management structure | Failure to intervene will perpetuate the cycle of collapsing commercial fisheries, and resulting economic hardship. |
| | 2. Habitat loss | 1. Lack of adequate land use controls to protect critical habitats from effects of population growth and development<br>2. Habitat degradation due to point and nonpoint pollutant inputs. | Failure to intervene will result in incremental loss of critical habitats, habitat degradation, eventual loss of biological diversity, and increased limitations on human use and enjoyment of natural resources. |
| 2. Limitations on water quality-dependent uses | 1. Fecal contamination | 1. Human sewage from WWTFs<br>2. Human sewage from CSOs<br>3. Human sewage from ISDSs, storm drains, boater discharges | Failure to more effectively disinfect WWTF discharges and abate CSO discharges will permanently limit shellfish harvesting in urban areas. Failure to abate nonpoint pollution sources will result in increased closures of harvesting areas in suburbanizing regions. |
| | 2. Toxics contamination | 1. Industrial discharges and emissions<br>2. Residential, commercial discharged, motor vehicle emissions and runoff<br>3. Accidental chemical spills | Failure to reduce use and disposal of toxic pollutants will result in long-term public health risk to seafood consumers, incremental environmental degradation, and damage to aquatic organisms. |

Table 3F-6 (continued) **SUMMARY OF BAY PROBLEMS, RANKED BY REGION**

| **SUBURBAN AND URBANIZING AREAS** (E.G., GREENWICH BAY, NREPORT HARBOR) | | | |
|---|---|---|---|
| **PROBLEM(S)** | **CAUSES(S)** | **SOURCE(S)** | **RISKS** |
| 1. Trend toward limitation on water quality-dependent uses | Fecal contamination | Human sewage from WWTFs, ISDSs, storm drains, boater discharges | Failure to abate or more effectively treat existing sources of fecal contamination, and failure to limit density of future development dependent on septic systems will result in increased closures of shellfish harvesting areas, and other limitations on water quality-dependent uses. |
| 2. Pockets of contaminated sediments | Toxics contamination and excess organic loadings | Historic and current discharges of toxic pollutants and domestic wastes from local industrial, commercial and residential sources | Failure to reduce use and disposal of toxic pollutants will result in further environmental degradation, may increase the long-term health risk to seafood consumers, and will limit future dredging and dredged material disposal options. |
| 3. Habitat degradation and loss | Lack of adequate land use and development density controls to protect critical habitats | Rate and pattern of population growth and development | Failure to protect remnant critical habitats will result in incremental loss of critical habitats for aquatic plants and animals, incremental degradation of water quality, and eventual loss of biological diversity. |

| **SUBURBANIZING AND UNDEVELOPED AREAS** (e.g., PARTS OF THE SAKONNET RIVER) | | | |
|---|---|---|---|
| **PROBLEM(S)** | **CAUSE(S)** | **SOURCE(S)** | **RISKS** |
| 1. trend toward habitat degradation and loss | Lack of adequate land use and development density controls to protect critical habitats and water quality | Rate and pattern of population growth and development | Failure to more effectively regulate land use and the density of development will result in incremental loss of critical habitats for aquatic plants and animals, and incremental degradation of water quality. |

| **MOUNT HOPE BAY** | | | |
|---|---|---|---|
| **PROBLEM(S)** | **CAUSE(S)** | **SOURCE(S)** | **RISKS** |
| 1. Limitations on water quality-dependent uses | 1. Fecal coliform | Combined sewer overflows - Fall River | Failure to abate Fall River CSOs will result in the continued permanent closure of 6,820 acres in Mount Hope Bay and parts of the Kickemuit River to commercial quahog, oyster, mussel fisheries. |

**SUMMARY OF BAY PROBLEMS, RANKED BY REGION**

| PROVIDENCE-SEEKONK RIVER | | | |
|---|---|---|---|
| **PROBLEM(S)** | **CAUSE(S)** | **SOURCE(S)** | **RISKS** |
| 1. Limitations on water quality-dependent uses. (Also applies to segments of the Blackstone, Pawtuxet, Woonasquatucket, Moshassuck and Ten Mile Rivers.) | 1. Fecal contamination | 1. Human sewage from WWTFs<br>2. Human sewage from CSOs | Failure to more effectively disinfect WWTF discharges will result in continued closure of 5,430 acres to shellfish harvesting and swimming. Failure to abate CSOs will result in continued (intermittent) closure of 9,853 acres to shellfish harvesting. |
| 2. Exceedance of Federal and State water quality standards intended to protect aquatic life and public health. (Also applies to segments of the Blackstone, Pawtuxet, Woonasquatucket, Moshassuck and Ten Mile Rivers.) | 1. Toxics contamination, and excess nutrient inputs | 1. Industrial, residential, commercial discharges through WWTFs and runoff (toxics)<br>2. Human sewage from WWTFs (nutrients) | Failure to reduce use and disposal of toxic pollutants will result in long-term health risk to seafood consumers, and further environmental degradation. Failure to reduce excess nutrient inputs could result in algal blooms, prolonged episodes of low oxygen, and/or fish kills. |
| 3. Contaminated sediments. (Also applies to segments of the Blackstone, Pawtuxet, Woonasquatucket, Moshassuck and Ten Mile Rivers.) | 1. Toxics contamination | 1. Historic and current discharges of toxic pollutants and domestic wastes from sources in the Providence River basin, including the Blackstone and Pawtuxet Rivers | Failure to reduce use and disposal of toxic pollutants will result in further environmental degradation and long-term public health risk to seafood consumers, and will limit future dredging and dredged material disposal options. |

4. The Narragansett Bay Estuary Program

a. Background

In 1985, Senator John H. Chafee and several of his colleagues in Congress recognized the need to plan for and protect the valuable resources that are the nation's estuaries and bays. They passes legislation to create four pilot estuary programs (Narragansett Bay, Buzzards Bay, Long Island Sound and Puget Sound). The programs were charged with studying the estuaries' problems and developing management plans to address those problems. In 1987, amendments to the Clean Water Act (section 320) officially created the National Estuary Program (NEP), incorporating those four pilots and adding eight other new programs. From 1985 to 1992, more than 100 people representing 45 federal, state, and local government agencies, universities, marine trade organizations, environmental advocacy groups, industry, and land development interests met under the aegis of the NBEP, to consider the future of Narragansett Bay and the Narragansett Bay basin. Over this seven year period, the U.S. EPA and the State of Rhode Island invested several million dollars in research, resulting in a Comprehensive Conservation and Management Plan (CCMP) for the Bay.

The NEPs are based on several themes: involvement of stakeholders in developing solutions; use of sound science in developing management programs; outreach and education for decision-makers and the public; and serving to coordinate existing actions and create collaborative initiatives to address estuary problems. The NEPs used extensive stakeholder involvement decision-making processes to create the CCMPs for each estuary and its watershed as mandated under Section 320. The programs were recognized as a new and effective method of watershed management. Due to the demand of states' governors and stakeholders for additional NEPs, the program has been expanded to include 28 NEPs in nearly all coastal areas of the U.S. These programs work closely together on national coastal policy issues and form a national network for coastal watershed solutions.

The Narragansett Bay Estuary Program (NBEP) started in 1985 under the name, the Narragansett Bay Project. Until early 1993, the program was staffed by EPA contractors. At that point, the Narragansett Bay CCMP was completed, signed by the Governor and the EPA Administrator, and became part of the R.I. State Guide Plan. RIDEM agreed to host the program and staff was hired to implement the plan. EPA provides approximately $300,000 per year to fund the program with a required state match of 25%. The program does not receive a direct state cash match but has been able, to this point, to get EPA to accept as match, funds spent by the state on CCMP-related projects that may or may not have NBEP involvement. Additionally, the NBEP has brought in an additional $2.3 million in competitive grant funding over the last six years to implement the Bay plan. The program prepares annual work plans based on CCMP priorities, subject to approval by the NBEP Implementation Committee (comprised of the directors of DEM, CRMC, NRCS, Statewide Planning, and representative from EPA Region I, Save The Bay, URI, RI League of Cities and Towns).

### Program Priorities

The CCMP is based on the following overall goals:

- To prevent further degradation and incrementally improve water quality in developing coastal areas with deteriorating water quality;
- To protect diminishing high quality resource areas throughout the Bay watershed;
- To more effectively manage commercially, recreationally, and ecologically important estuarine-dependent living resources;
- To rehabilitate degraded waters in the Bay watershed and restore water quality-dependent uses of Narragansett Bay;
- To establish necessary interstate and interagency agreements and mechanisms to coordinate and oversee implementation of the Narragansett Bay CCMP.

Following these priorities, the NBEP has conducted numerous successful projects and initiatives. Some examples are:

- Taking the state lead on implementing the Greenwich Bay Initiative, a nationally-recognized watershed management effort;
- Organizing a collaborative effort to identify and map critical coastal resources and to set priorities for habitat restoration actions;
- Funding shellfish management studies and plans for the Bay;
- Creating a demonstration project targeting the reduction of hazardous waste, the Hazardous Waste Reduction Program, which provided needed technical assistance to private industry to develop processes that reduced the use of toxic materials while saving money. Due to the success of the program, RIDEM instituted it as an ongoing state program;
- Developed the Phosphorus Reduction Act, passed by the R.I. Legislature in 1995, which prohibits the sale of cleaning products containing more than a certain percentage of phosphorus, a nutrient that, in excessive amounts, is harmful to waterbodies;
- Updating the state's septic system regulations and testing alternative systems, more protective of the coastal environment;
- Developing collaborative efforts to train and inform local officials on nonpoint source pollution and land management;
- Instituting the first annual dissolved oxygen surveys of Narragansett Bay to better understand the impacts of nutrient inputs on the Bay ecosystem;
- Partnering with Brown University and NASA to provide remote sensing data that allowed the State to better assess the thermal impacts of a power generating plant discharging to Mt. Hope Bay;
- Assisting and building GIS capacity for coastal communities to more effectively manage harbors and protect coastal resources;
- Working with URI and Roger Williams University to initiate a Bay-wide monitoring system using electronic sampling buoys at thirteen sites throughout the Bay;
- Organizing the collaborative effort that presented the Narragansett Bay Summit 2000 and working with stakeholders on follow up actions based on the Summit results.

## Future Directions

In April 2000, the NBEP organized a collaborative effort to assess the status of not only the Bay's environmental resources but its economic uses. The Narragansett Bay Summit 2000 brought together scientists, state, federal and local resource managers, decision-makers and the public to examine how we use the Bay and how we can ensure that the Bay remains a sustainable environmental system and economic resource. The Summit featured presentations on the Bay ecosystem and uses of the Bay; also included were panel discussions on Bay issues and an opportunity for the 350 participants to prioritize issues and actions. The discussions were based on data from seven "white" papers developed by teams of stakeholders in the months prior to the Summit. A final report including all seven finalized which papers as well as the results of the participatory discussions will be available in Summer 2000. As was intended, the Summit has acted as a springboard for action for the Bay. Briefings on the Summit results are planned for the State legislature and numerous projects and partnerships are coalescing around recommendations for action that came out of the Summit. Listed below are issues and actions that emerged as Summit priorities. The actions fall under four general categories of action:

Creation or expansion of a Bay Plan or Planning Process: This would include development of a vision statement for the Bay, coordination of existing planning initiatives, and integration of economic, environmental and social equity issues.

Ecosystem Improvement Actions: Priorities include habitat restoration actions, CSO abatement, reduction of nutrient and pathogen inputs to the Bay, and expanded funding for environmental improvements.

Inform Decision Making: Priorities in this category include increased Bay monitoring and Bay resources programs, development of an economic characterization of the Bay and related economic trends studies, creation of a coordinated data management mechanism and access to data (potential role for the URI Coastal Institute), development of ecological indicators and creation of effective outreach and training programs for officials and the public.

Economic Development: Actions to be taken include development of high-value tourism jobs, promotion of Brownfields reuse, development of economic opportunities from research/technology, improvement of marine infrastructure, creation of a dredged materials plan, revitalization of urban areas and property tax reform, and managing for sustainable fisheries.

The NBEP intends to incorporate the direction and guidance provided by the Summit as it develops its upcoming annual work plans. The Summit will also serve as a basis for a planned revision to the Narragansett Bay Comprehensive Conservation and Management Plan.

The program will continue its role serving as a coordinator entity for Bay actions and organizing and creating collaborative efforts to meet common goals. The program will focus on: expanding its partnership activities with municipalities, agencies and nonprofits; securing the scientific data needed to support policy initiatives and develop effective management strategies; providing outreach on the Bay and watershed ecosystem through workshops, conferences, and educational events; securing additional funding for CCMP implementation; addressing priority water quality and living resource issues in the Bay; identifying and analyzing emerging Bay issues (e.g., introduced species); and building work plans that reflect the action items identified in the CCMP and at the Bay Summit 2000.

5. Marine Sanitation Devices (MSDs)

The Rhode Island marine areas have experienced a rapid expansion of moorings and marinas in the last ten years, with the number of boats on Rhode Island waters having more than doubled. Approximately 34,000 boats are of a size to have marine sanitation devices (MSDs) on board which are potential sources of bacterial contamination. Legislation was passed in 1991 addressing Marine Discharges of Sewage. The State law gives powers to boating safety officers, local harbor masters and the police to enforce MSD laws.

In Rhode Island, if a vessel has a marine head (toilet) installed on board, it must be U.S. Coast Guard-certified and a type authorized in the area where it will be operated. There are three types of USCG certified marine sanitation devices: Type I, II or III.

**Type I** - Flow-through; effluent USCG certified to 100 fecal coliform/100 ml with no visible floating solids.

**Type II** - Flow-through; effluent USCG certified to 200 fecal coliform/100 ml, 150 mg/1 total suspended solid standard.

**Type III** - USCG certified to no discharge standard (holding tank).

Under the federal Clean Water Act it is illegal to discharge untreated (raw) sewage from a vessel within 3 miles of shore (the territorial waters) of the United States, the Great Lakes and navigable rivers. On August 10, 1998 the state of Rhode Island took a step toward ensuring better water quality in marine waters by designating their coastal waters as a No Discharge Area (see next section). The Rhode Island waters include territorial seas within three miles of shore, including all of Narragansett Bay. A No Discharge Area is a designated body of water in which the discharge of *treated* and *untreated* boat sewage is prohibited (this does not include greywater or sink water). It is the Department's goal to promote the use of Type III (MSDs) through the declaration of no discharge areas. Complying with vessel sewage discharge laws and regulations, and using pumpout facilities, are a necessary step to protect public health, water quality, and the marine environment.

6. Marine Pump-out Facilities and No Discharge Area Designation

A Narragansett Bay Marina Pumpout Siting Plan was developed by NBEP staff. With an estimated 160 private marinas, yacht clubs, boat yards, town docks, and launching ramps operating in the Bay, and over 32,000 registered boats (1991) being served. The RIDEM Office of Water Resources, obtained funding through the Federal Clean Vessel Act grant program and oversaw the construction of pump-out facilities throughout the marine waters of Rhode Island. Thanks also to the commitment of the state’s marina operators, Rhode Island now has a total of 54 pumpout facilities from Providence to Block Island. These include shoreside facilities as well as mobile pump-out boats. A map of the locations and listing of addresses of the RI pumpout facilities can be found on the RIDEM website at www.state.ri.us/dem.